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Clinically functional outcome of anatomically irreducible C3 pilon fracture classified depending on C.T. scan guidance and managed with Ilizarov method: a case report from Palestine

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ABSTRACT

Tibial plafond (pilon) fractures are uncommon kinds of bone fractures that are difficult to manage and critical to classify. They are considered an enormous challenge for orthopedic surgeons and rehabilitation staff, especially when comminuted at the articular surface and anatomically irreducible. We present a case of high-energy tibial pilon fracture with CT-guided classification and Ilizarov method management. Although it could not reach anatomical reduction due to severe articular comminution, it yielded a functional clinical outcome after a short period of apparatus removal.

Keywords: Pilon, Ankle, Ilizarov, Anatomical Reduction, fixation.

INTRODUCTION

The pilon or tibial plafond fracture is a rare type of bone damage that is difficult to treat due to its location [1]. It is difficult to achieve good clinical outcomes with this type of fracture, which accounts for less than 1% of lower leg fractures [2, 3]. The pilon fracture usually occurs when the talus gets slammed into the tibia due to compression in the axial direction. The type of pilon fracture depends on the position and rotation of the foot at the accident time[4]. High-energy trauma, such as a fall from a height, a vehicle or motorbike accident, or a skiing accident, is the most common cause of a pilon fracture [5].

The management method and course must identify the fracture type. C.T. images are superior to radiographs in identifying the articular fragments [6].

Many orthopedic surgeons prefer limited internal and external fixation for complicated, open tibial pilon fractures [7, 8].

This type of bone fracture has been cured several times throughout orthopedic surgery, but the best results have occurred using the Ilizarov fixator technique. This greatly benefits intra-articular comminuted tibial pilon fractures with dubious soft tissue integrity. It can also aid in the development of arthrodiastasis in the treatment of these fractures [9].

Using the Ilizarov external fixator to treat pilon fractures is beneficial in preserving the endosteal and periosteal blood supply. It also assists in the reduction of fracture fragments by ligamentotaxis. Compression of fracture fragments is possible by the use of olive wires. The Ilizarov technique also has the advantage that the rigidity of fixation can be adjusted to suit the stage of fracture healing [10].

In their study, Jessica Bear *et al.2018,* referred to literature, noting that while the quality of articular reduction has been shown to affect radiographic arthrosis, studies have been unable to demonstrate a link between the quality of articular reduction and outcomes. Also, while a link between restorations of fibular length and functional outcomes was shown, there was no correlation between articular step-off and articular gap [11].

Regarding ankle range of motion ROM, several studies showed that ROM in the sagittal plane is between 65 and 75°, moving from 10 to 20° of dorsiflexion D.F. through to 40–55° of plantarflexion P.F. However, in everyday activities, the ROM required in the sagittal plane is much reduced, with a maximum of 30° for walking, and 37° and 56° for ascending and descending stairs, respectively [12].

It is well known that early movement eliminates joint stiffness and provides the best outcomes. We present a unique case of a complex tibial pilon fracture anatomically irreducible yet yielded a functional and comfortable ankle motion.

The patient was informed that the case would be submitted for publication. We are not aware of any similar study conducted in Palestine.

Case report

A 44-year-old male patient who weighed 115 kg was referred to our department from another hospital with a severely comminuted type III left pilon fracture (Ruedi-Allgower classification), type C3-AO classification. The patient's history started with a high-impact fall down on their feet during work on June 7, 2021. He was admitted to An-Najah University Hospital on June 9, 2021, and was prepared for surgery on the next day, June 10, 2021.

In order to prevent edema, the left leg was placed on a below-knee back slab with lower leg elevation. Radiology and computed tomography scanning were done to screen for damage in the tibial bone plafond (Figure 1) and score the type.

Figure: (1a)

Figure: (1b)

Figure: (1c)

Figure (1): Preoperative Lateral (a) and A.P. (b), X- Rays, and coronal C.T. (c).

C.T. was superior in showing how fragmented the fracture was at the articular surface, indicating that anatomical reduction would be impossible in such severe fragmentation.

The operation was conducted by the author using the Ilizarov surgical technique. Standard preparation procedures were conducted on the C-arm fluoroscopic control. The patient was laid supine with under-knee and foot supports to give space for frame placement.

Closed reduction of the fracture was made possible with gentle manipulation and manual distraction. The proximal to fracture Ilizarov tibial construct (Hippokrat ®) consisted of three rings starting from the junction of the proximal tibial 1st and 2nd quarter to just 2 cm proximal to the fracture site; This part was mounted and fixed initially. The foot construct was then mounted and fixed accordingly. Distraction was done between the two constructs to achieve the best possible reduction at the fracture site, giving the most attention to the articular part of the fracture, with proper bone contact, orientation, and correcting any angulation. Rods were then inserted to connect the two constructs in the desired orientation with the addition of an initially free ring at the distal metaphyseal tibial level between them for further fracture reduction and fixation. This distal metaphyseal tibial ring was then held with 2 wires to the bone, one of which was an olive wire. Due to the fractured nature of comminution and proper distance control, it was impossible to put more than one ring there. The olive wire placement aided in more reduction of the comminuted metaphyseal part. Comminuted joint steps were corrected satisfactorily, though not perfectly. More medial malleolus was reduced with an oblique olive wire support by gentle hammering first, then controlled wire traction and connection to the Ilizarov frame. Soft tissue safety and mobility were highly considered and insured. The whole Ilizarov frame was fixed and connected methodically (Figure 2). Regular cleaning and dressing were done.

Figure (2): Postoperative lateral X-Ray view.

The patient was started on prophylactic antibiotic: Cefuroxime 750mg pre and postoperatively according to clean surgery protocol, Rivaroxaban 10 mg daily was started, and paracetamol 500 mg was used for pain control with proper dosing. No specific diet was advised. We instructed the patient not to be smoking for the whole period of the healing process.

The patient was ambulated with non-weight-bearing walker assistance on the second postoperative day, discharged on the third postoperative day, and followed up regularly.

On August 14, 2021, approximately after two months of surgery, the foot frame was removed (Figure 3), the foot was in a neutral position, and physiotherapy for passive and active ankle exercises began.

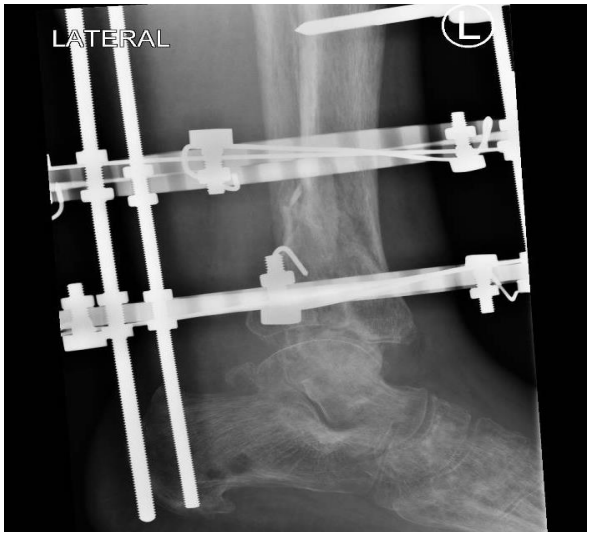

Figure (3): Post foot frame removal x-ray.

Three weeks later, and on September 11, 2021 visit, apparatus dynamization was performed, and partial weight bearing was allowed gradually to reach full weight bearing (FWB) at the 4-month point of operation, i.e., October 10, 2021. When radiological healing was assisted at the 6-month postoperative point, i.e., December 12, 2021, visit, the whole frame was removed (Figure 4). Here, the patient could move his ankle from neutral (D.F. zero) to 25 degrees of P.F.

Figure (4): Post full frame removal x-ray.

At 7 months postoperatively, he was freely mobile, and at 8 months postoperatively, and on his 06th February 2022 visit, he had 10/17 degrees of DF and 40/50 degrees of P.F. in comparison between injured and normal ankles' motion with no swelling, no pain, or deformity (Figure 5). Physiotherapy continued to regain more motion.

Figure (5a) **Figure (5b)** **Figure (5c)**

Figure (5): Plantarflexion (a) and dorsiflexion (b, c) views.

RESULTS

The injured ankle ROM was 10 degrees of DF to 40 degrees of P.F., totaling 50 degrees, compared to DF of 17 and P.F. of 45 on the normal side, totaling 57 degrees. So, the injured ankle returned 88% (ROM of injured ankle /ROM of normal ankle = 50/57) /of the patient's norm. We also do expect more motion with continuing physiotherapy.

DISCUSSION

A balance between benefits and hazards should be considered in managing high-energy fractures, and pilon ones are part of them. Soft tissue preservation, a small area of internal fixation, important blood supply preservation, limited ability to manipulate, and other important things are always taken into account [13].

C.T. scan-guided classification proved to be very important in determining the articular fracture's level of fragmentation and whether or not internal reduction and fixation should be made. This gave us a good idea of whether or not internal reduction and fixation should be made.

In many cases, the Ilizarov method was better than open reduction, internal fixation, or more manipulation when it was thought these things could be dangerous [14].

As orthopedic surgeons, we agree that a perfect anatomical reduction in any fracture will improve the patient's ability to move, especially in articular fractures.

In pilon fractures, anatomical reduction, if possible, will affect radiographic orthosis, yet there is still no proof to link anatomical reduction to the outcome. Not to say that we should stop trying to get an anatomical reduction, but to emphasize that in some cases, when it is not possible because of the unique circumstances of a fracture, and when the right type of fixation is used, it can still be functionally acceptable [15].

Our patient had a high-energy Type III Pilon fracture with non-favorable clinical or C.T. status for open reduction or internal fixation. The articular fracture was comminuted, and the distal metaphyseal-epiphyseal part was small. The distal fibula was also comminuted and shortened. It was decided to go for the Ilizarov method of fixation as a definitive way of management. Intraoperatively, safe methods were used to aid the best possible closed reduction and resulted in the restoration of fibular length and an accepted, yet non-anatomical, reduction of the plafond. Ilizarov was mounted from leg to foot.

Eight weeks later, the foot frame was removed, and early active and passive motion started. After six months of the injury, the fractures were healed, and all the apparatus was removed. After four months of surgery, FWB was allowed with the help of crutches and a leg frame.

CONCLUSION

As a case report, we wanted to set an example of a situation in which there was no place for anatomical reduction for C3 Pilon fracture, yet a meticulous management protocol yielded a functional ankle joint.

Consent

Written informed consent was obtained from the patient to publish this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.' IRB approval was attained.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

K.I. – performed the surgery, conceived the idea, wrote the paper, and analyzed the notes.

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